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# Prevalence of Respiratory Symptoms and Allergic Sensitivity in Multiply Handicapped Children

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*Among the many challenges of providing care for children with multiple physical and developmental handicaps is the proper management of their respiratory difficulties. This study was designed to evaluate the prevalence of respiratory symptoms in children attending a multidisciplinary clinic for handicapped children. We also used several methods to estimate the prevalence of allergic sensitivity in children with respiratory complaints. Questionnaires concerning respiratory symptoms were completed by the parents of 104 patients. The most frequent complaint reported was snoring in 41% of the children. Of the 39% who had multiple respiratory symptoms, 85% had detectable allergen-specific IgE to cat, dog, or house-dust mites. We conclude that most handicapped children with multiple respiratory complaints are allergically sensitive. (Henry Ford Hosp Med J 1986;36:219-21)*

Cerebral palsy, metabolic diseases, and traumatic injuries may lead to multiple physical and mental handicaps. Children with these multiple problems present many challenges to their medical care providers, including frequent complaints of respiratory difficulties. These respiratory complaints are often assumed to be a direct result of the children's physical and neurologic problems.

Allergic sensitivity, associated with rhinitis and asthma, is the most common cause of chronic respiratory disease in children (1). Since allergic sensitivity is not expected to occur less frequently in handicapped than in normal children, many of the respiratory symptoms of handicapped children could be the result of allergic sensitivity.

The purpose of this study was to determine the frequency of common respiratory complaints in multiply handicapped children and the prevalence of allergic sensitivity in those children with multiple respiratory symptoms.

## Patients and Methods

Patients were recruited from the multidisciplinary clinic (MDC) for handicapped children at Henry Ford Hospital. Most children seen in this clinic have multiple physical and developmental handicaps, most commonly secondary to cerebral palsy. The patients' socioeconomic backgrounds are diverse.

During regularly scheduled visits, the parents or guardians of MDC patients were asked to complete a brief form concerning the presence or absence (in the opinion of the parent) of nine common respiratory symptoms. The symptoms are listed in Table 1. If the parents responded positively to three or more of the nine symptoms, they were asked for permission to include their child in the second phase of this study. If permission was

Table 1  
Frequency of Respiratory Complaints\*

Complaint	Prevalence
Excess mucus	27%
Snoring	41%
Nighttime cough	21%
Interrupted sleep	12%
Trouble breathing	13%
Nosebleeds	17%
Ear infections	17%
Pneumonia	36%
Allergies	21%

\*Percentages of children reported by their parents as currently having each problem. Since most children had multiple complaints (39% had three or more complaints), the percentages total more than 100%.

granted, a nasal smear and a venous blood sample were obtained from the patient.

Human rights concerns prevented us from obtaining samples from children with few or no respiratory symptoms. The study was approved by the Henry Ford Hospital Human Rights Committee.

The screening tests performed were estimations of the percentage of eosinophils in the nasal smear, a multiantigen radioallergosorbent test (multi-RAST), and individual enzyme-

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**Table 2**  
**Comparison of Multi-RAST and ELISA Results\***

		ELISA	
		All Negative	One or More Positive
Multi-RAST	Negative	5	18
	Positive	1	15

$$\chi^2 = 1.74.$$

$$P = 0.19.$$

\*A comparison of the results of two different in vitro tests for allergen-specific IgE for sera from 39 children with three or more respiratory complaints.

linked immunosorbent assays (ELISA) for cat-, dog-, and mite-specific IgE. The nasal smears were obtained by gently swabbing mucus from the nose using a small calcium alginate swab (Calgie swabs, Spectrum Labs, Houston, TX). The mucus was spread on the slide and air dried. After staining with Wright's stain, 100 nucleated cells were counted (eosinophils, neutrophils, and epithelia cells). The frequency of eosinophils is expressed as a percentage of total cells counted. In a previous study we found that  $\geq 4\%$  eosinophils provided the best estimate of allergy (2).

The diagnosis of allergic disease depends on the physician's evaluation of signs, symptoms, physical findings, and tests for allergen-specific IgE antibodies, since no single test or group of tests will produce an accurate diagnosis. Typical immediate type allergic reactions cannot occur, however, unless an individual has produced allergen-specific IgE antibodies. A positive test for the presence of allergen-specific IgE, therefore, demonstrates that an individual has been sensitized and has the potential for developing allergic symptoms. Since it was not feasible to evaluate each child fully for allergy, we used two different in vitro tests to detect allergen-specific IgE.

The first test was the multi-RAST which we have previously compared to skin testing and individual discrete RASTs. When compared to skin tests, the multi-RAST has a sensitivity of 63% and a specificity of 96%. We also used an ELISA for detecting cat-, dog-, and dust mite-specific IgE. These allergens were chosen because we have found that these are the most common indoor allergens producing sensitization.

The multi-RAST was performed as reported previously (2). Briefly, extracts of house-dust, ragweed, and grass (Hollister-Stier, Spokane, WA) were each individually coupled to cyanogenbromide-activated microcrystalline cellulose and checked for their capacity to absorb IgE. Equal portions of the individual immunosorbents were then mixed. The test was performed by adding 50  $\mu$ L of serum to 500  $\mu$ L of the mixed immunosorbent in a total volume of 1 mL. After overnight incubation, the immunosorbent was washed, and the amount of IgE binding to the immunosorbent was quantitated by the addition of radioactively ( $^{125}$ I-) labeled antihuman IgE (Pharmacia Diagnostics, Inc, Piscataway, NJ). The analytic sensitivity of the multi-RAST has been shown to be equal to that of three discrete RAST determinations using the same allergens (2). Cat-, dog-, and dust mite-specific IgE were measured using an ELISA as reported (3). The test is performed by first coating the relevant allergen extract

(Hollister-Stier) on to plastic microtiter strips (Microfluor B removawell, Dynatech Inc, Alexandria, VA). The coated strips are washed and blocked to prevent further passive absorption. Fifty microtiter aliquots of the patient's serum are then added to triplicate sets of wells followed by an overnight incubation. After incubation, the wells are washed, and the amount of allergen-specific IgE bound in the wells is quantitated by the addition of labeled antihuman IgE (3).

## Results

A total of 104 patients (49 females, 55 males) with a mean age of 12 years (range, 2 to 23 years) were studied. Histories of three or more of the nine respiratory symptoms presented in Table 1 were present in 41 (39%) of the patients. Table 1 also presents the frequency of each individual complaint. Snoring was the most frequent complaint, followed by pneumonia in over one-third of the patients.

Nasal smears were performed on 38 of the 41 eligible patients, and only one smear was positive with 36% eosinophils.

Blood samples were available for 40 of 41 patients. The multi-RAST was positive in 16 (40%) of the 40 serum samples.

After the multi-RAST was performed, adequate serum was available for completion of the three ELISAs for 39 patients. Cat-specific IgE was detectable in 27 (69%), dog-specific IgE was detectable in 29 (74%), and dust mite-specific IgE was found in 12 (31%) of the patients. One or more of the ELISAs were positive in 33 (85%) of the patients. Thus, 33 patients of the 104 initially screened were allergically sensitive as defined by the presence of allergen-specific IgE.

Table 2 compares the results of the multi-RAST and the ELISA. While there was general agreement, one or more of the ELISAs were positive in 18 children with negative multi-RASTs.

## Discussion

This study demonstrates an 85% prevalence of allergic sensitivity, as measured by ELISA, among handicapped children with three or more respiratory symptoms. While the study design did not permit ascertainment of the prevalence of allergic sensitivity in the total MDC population, a minimal estimate of total prevalence would be 33 of 104 children or 32%. This prevalence is consistent with the estimated prevalence of allergic disease in normal children (4). Even though the study measures only association, the 85% prevalence of allergic sensitivity among children with respiratory symptoms is highly suggestive of a cause-and-effect relationship.

These results suggest that allergy should be considered as a possible cause of respiratory symptoms in handicapped children. Mild symptoms may respond to mild medications or reduction in allergen exposure (ie, removal of the cat or dog from the local environment). More severe symptoms or those not responsive to simple therapy should prompt a referral for a more careful allergy evaluation.

Interestingly, among the 41 symptomatic children in this study, allergy had been mentioned to many parents as a possible cause of the symptoms but only three children had ever been referred for an evaluation.

The results of comparing the screening tests are as expected. The nasal smear is inexpensive and easy to perform but is not a sensitive test (2). The multi-RAST has been previously studied in children and was found to have a diagnostic sensitivity of 67% when compared to a panel of skin tests. The multi-RAST was as sensitive as three individual RASTs using the same allergens. The difference in apparent sensitivity between the multi-RAST and the three ELISAs is most likely the result of using different individual allergens. In the interval since the multi-RAST was developed, additional in vitro studies have shown that cat and dog are the most common allergens producing sensitivity in young children. For this reason, cat, dog, and dust mite were chosen for the ELISA tests.

We conclude that allergic sensitivity is frequently associated with respiratory symptoms in handicapped children and that allergy must therefore be considered in the management of these children.

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